The antenna gain is 45.3 dBi at 13 GHz and the half power horizontal beamwidth is 0.9°. The employed receiver is assumed to have 25 MHz bandwidth with a 30 dB S/N threshold of -83 dBm. Based on geometrical symmetry, we shall assume that the vertical antenna gain pattern is identical to that in the horizontal plane.

The selection of the 6 foot diameter antenna was based on analysis results displayed in Table D2.3.4-1. Table D2.3.4-1 shows that the worst case coupling with a Globalstar satellite occurs at the horizon with the highest main beam gain antenna. Furthermore, should the largest antenna be tilted up or down, the worst case remains for the largest antenna utilized, the 6 foot diameter antenna in this case.

TABLE D2.3.4-1

Elevation Angle (degrees)	PFD ($dBW/m^2/4$ kHz)	6 Ft. Net Gain (dBi)[2]	Adjusted Interference Power I_R (dBm)[1]	4 Ft. Net Gain (dBi)	Adjusted Interference Power I_R (dBm)	2 Ft. Net Gain (dBi)	Adjusted Interference Power I_R (dBm)
0	-173.5	45.3	-103.9	41.5	-107.7	35	-114.2
5	-171.5	15.3	-131.9	9.5	-137.7	15	-132.2
10	-169.5	6.3	-138.9	9.5	-135.7	8	-137.2
15	-168.5	6.3	-137.9	4.5	-139.7	3	-141.2
20	-166.5	3.3	-138.9	0	-142.2	2	-140.2
25	-165.5	3.3	-137.9	0	-141.2	1	-140.2
30	-164.5	0.3	-139.9	-3.5	-143.7	0	-140.2

Table D2.3.4-1
Maximum Interference Power Determination for 6, 4 and 2 Foot Diameter Parabolic Antennas in the 12.75 - 13.25 GHz Band

Note 1: I_R = -178.2 + 38 + (antenna net gain) (dBm)

No polarization advantage was used.

Vertical antenna pattern was assumed equivalent to horizontal pattern.

Note 2: Antenna net gain = (main beam gain) - (vertical directivity)

Fade Margin (dB)	Obstruction Losses (dB)[3]	Receive Carrier Level (dBm)	C/I (dB)[1]	C/I Objective (dB)[2]
45	0	-38	65.9	54
40	5	-43	60.9	54
35	10	-48	55.9	54
30	15	-53	50.9	54
25	20	-58	45.9	54
20	25	-63	40.9	54
10	35	-73	25.9	54
0	45	-83	20.9	54

Table D2.3.4-2
Performance of Configuration IV for 13 GHz ENG.
6 Ft. 13 GHz antenna, tower mounted with an attached 25 MHz radio with -83 dBm of threshold. One Globalstar satellite is assumed present.

Note 1: Based on I_R of -103.9 dBm.

Note 2: Objective deduced in Section 2.1.2.1.1..

Table D2.3.4-2 shows that the C/I objective will be maintained for fade margins equal or greater than 33 dB. The minimum C/I of 20.9 dB maintains a 44.3 dB of S/N according to Section 2.1.2.1.1 where the C/I is given by C/I = S/N - 23.44 (dB). Combining the 30 dB S/N (completely faded link) and 44.3 dB gives less than 0.25 dB of degradation. The C/I in Table 2.3.4-2 assumes that no correlated fading exist between the satellite signal and that of the 13 GHz ENG link. It also assumes that the fading of the ENG happens at the same time the satellite is present in the main beam.

We expect, at low elevation angles for correlated fading to occur between the satellite signal and the ENG link. For example, assuming that the satellite signal will encounter a 1 km rain cell, then the additional suffered attenuation is enhanced by 1.8 dB (based on 0.9 dB/1 km for 25 mm/h rain rate at 13 GHz). I_R becomes -103.9 - 1.8 = -105.7 dBm. If the ENG path is completely faded, i.e. C = -83 dBm, then the C/I is 22.7 dB corresponding to 46.1 dB S/N which maintains the ENG S/N at 29.85 dB. This, more likely, will not cause a problem. Also, threshold degradation will not be more than 1 dB.

E

APPENDIX E - UPLINK PRIVATE OPERATIONAL-FIXED SERVICE

(6525 - 6875 MHZ)

E1.0 Introduction

E1.1 General

In this Appendix, an uplink from a Globalstar feeder station operating in the 6525 to 6875 MHz Private Operational-Fixed Microwave band is analyzed. The upper 6 GHz frequency band is extensively used by private industry for internal communication requirements. Primarily used for "backbone" applications, the band has been growing steadily over the past 5 years with roughly 19,000 frequency assignments in existence today. In the past, most microwave systems in the upper 6 GHz band used analog modulation schemes with traffic capacities that varied between 120 and 780 channels. Recently, the trend has been to use digital modulation schemes for implementing new systems and replacing existing analog systems. These digital systems utilize capacities from 4T1 (6.312 Mbps) to 1DS3 (45 Mbps). This band is a candidate for relocation of displaced 2 GHz users.

The analysis was performed at two locations and was based on the actual terrestrial microwave environment and the parameters of the proposed Globalstar feeder station. Sites were analyzed in Rapid City, South Dakota and Staten Island, New York to get a feel for the difficulties that may be encountered by a feeder station sharing the spectrum with point-to-point terrestrial stations in a non-congested (Rapid City) and a congested (Staten Island) microwave environment.

E1.2 Basis for Analysis

The following parameters were used in the analysis.

- The maximum Globalstar uplink power density is -7.0 dBW/4kHz into the antenna.
- The proposed 3.4 meter antenna has a main beam gain of 45.4 dBi at 6.7 GHz.
- The 6.7 GHz antenna has a beamwidth of 0.8 degrees and 1.6 degrees for the 3 dB and 15 dB points respectively.
- The interference objective is -154 dBW/4kHz for 20 percent of the time at 6.7 GHz. This is based on current procedures followed to coordinate earth station pointing at the geostationary orbit. These procedures comply with the Code of Federal Regulations 47, Part 25.

- The earth station antenna gain pattern conforms to 32-25logθ towards the horizon. This is the pattern used in the frequency coordination with terrestrial users as stated in Code of Federal Regulation 47 Part 25 Section 25.251(c)(4).

- Based on a minimum elevation angle to the Globalstar satellite of 10 degrees, the feeder link antenna gain towards the horizon is 7 dB (32-25 log 10 = 7 dB).

- The maximum power density from the earth station towards the horizon is 0 dBW/4kHz (-7 dBW/4kHz + 7 dB = 0 dBW/4kHz).

- The Globalstar satellite arc considered was from 0 to 360 degrees with the minimum feeder link antenna elevation angle of 10 degrees in all directions.

- A coordination distance with a 250 kilometers radius was selected. The coordination distance is the distance within which all potential interference is evaluated. The 250 km distance corresponds to the maximum coordination distance for a geostationary earth station with equivalent parameters and a minimum elevation angle of 10 degrees.

- The orbital mechanics and the relationship to the amount of time the terrestrial station main beam is in the direction of the satellite is not addressed in this report.

E2.0 Methodology

E2.1 Approach

The goal of this study was to determine the potential interference cases that might be expected from a Globalstar feeder link earth station operating with the parameters given in Table E2.1-1.

For a potential uplink location, standard procedures have been followed. Two sites have been selected, one in a microwave non-congested area, Rapid City, South Dakota. The second site was selected in a congested area, Staten Island, New York.

E2.2 Computer Analysis

Comsearch's extensive electronic database was utilized. Computerized calculations have been carried out for all terrestrial facilities within the selected coordination contour. These

SATELLITE EARTH STATION
FREQUENCY COORDINATION DATA
04/22/94

OWNER:	Globalstar
EARTH STATION NAME, STATE	RAPID CITY SD
LATITUDE (DMS):	44 5 0.0
LONGITUDE (DMS):	103 10 0.0
GROUND ELEVATION AMSL (FEET/METERS)	3260.0 / 993.6
ANTENNA CENTERLINE AGL (FEET/METERS)	12.0 / 3.7
TRANSMIT ANTENNA TYPE : 29 34	
6.0 GHZ GAIN (DBI)/DIAMETER (METERS):	45.4/ 3.4
3 DB/15 DB HALF BEAMWIDTH (DEG.):	0.40/0.80
OPERATING MODE:	TRANSMIT ONLY
TRANSMIT BAND (MHZ):	6525 - 6875
EMISSION DESIGNATOR	
MODULATION:	DIGITAL
MAX. AVAILABLE RF POWER (dBW/4KHZ):	-7.0
(dBW/MHZ):	17.0
MAX. EIRP (dBW/4KHZ):	38.4
(dBW/MHZ):	62.4
MAX. PERMISSIBLE INTERFERENCE POWER	
6.0 GHZ, 20% (dBW/4KHZ)	-154.0
6.0 GHZ, 0.0025% (dBW/4KHZ)	-131.0
RANGE OF SATELLITE ARC IN DEGREES (MIN/MAX):	0.0/ 359.0
AZIMUTH RANGE (MIN/MAX):	0.0/ 360.0
CORRESPONDING ELEVATION ANGLES:	10.0/ 10.0
RADIO CLIMATE:	A
RAIN ZONE:	5
MAX. GREAT CIRCLE COORDINATION DISTANCE (MI/KM)	
6.0 GHZ:	155.3 / 250.0
PRECIPITATION SCATTER CONTOUR RADIUS (MI/KM)	
6.0 GHZ:	62.1 / 100.0

NOTE: HORIZON IS LESS THAN 0.2 DEGREES AT ALL AZIMUTHS

Table E2.2-1

computations include computing the expected line-of-sight interference power into each OFS station within 250 km from the Globalstar feeder link earth station site. Specific data such as antenna directivity, fixed losses, and exact coordinates are used.

Table E2.2-1 presents a list of typical predicted interference conflicts. For cases which did not clear the interference criteria over-the-horizon loss (OH), was estimated using Comsearch propagation models. Note that these OH models are the same ones used to predict propagation losses for interference prediction in the OFS bands.

DESCRIPTION OF GREAT CIRCLE INTERFERENCE CASE HEADINGS

TERRESTRIAL PATH:	SITE NAMES AND STATE OF THE TERRESTRIAL PATH THAT THE FIRST SITE LISTED IS THE TERRESTRIAL STATION INVOLVED IN THE INTERFERENCE CONFLICT.
LATITUDE:	LATITUDE OF THE INVOLVED TERRESTRIAL STATION.
LONGITUDE:	LONGITUDE OF THE INVOLVED TERRESTRIAL STATION
CALL:	FCC CALL SIGN OF THE INVOLVED TERRESTRIAL STATION
OWNER:	OWNER OF THE TERRESTRIAL PATH
GROUND ELEVATION:	GROUND ELEVATION (AMSL) OF THE INVOLVED TERRESTRIAL STATION
ACL:	ANTENNA CENTERLINE (AGL) OF THE INVOLVED TERRESTRIAL STATION
EDISCT:	EARTH STATION DISCRIMINATION ANGLE, IN DEGREES, TOWARD THE INVOLVED TERRESTRIAL STATION
TDISCT:	INVOLVED TERRESTRIAL STATION DISCRIMINATION ANGLE, IN DEGREES, TOWARDS THE EARTH STATION
GES:	GAIN OF THE EARTH STATION IN dBI AT THE CALCULATED EARTH STATION DISCRIMINATION
GTS:	GAIN OF THE INVOLVED TERRESTRIAL STATION IN dBI AT THE CALCULATED TDISCT
FSLOSS:	FREE SPACE PROPAGATION LOSS IN dB DUE TO THE DISTANCE BETWEEN THE EARTH STATION AND THE INVOLVED TERRESTRIAL STATION AT THE INTERFERENCE FREQUENCY
TANT:	INVOLVED TERRESTRIAL STATION ANTENNA CODE AND TYPE
DIST:	DISTANCE BETWEEN THE EARTH STATION AND THE INVOLVED TERRESTRIAL STATION IN KILOMETERS
AZIMUTH:	AZIMUTH IN DEGREES FROM TRUE NORTH FROM THE EARTH STATION TO THE INVOLVED TERRESTRIAL STATION
PR:	CALCULATED POWER RECEIVE IN dBW. PR = GES + GTS + (TPWR - 30) - FSLOSS - LL FOR RECEIVE PR = GES + GTS + PES - FSLOSS - LL FOR TRANSMIT
PES:	POWER OF EARTH STATION IN dBW/4 KHz
MARGIN:	MARGIN IN dB TO THE INTERFERENCE OBJECTIVE. THIS VALUE IS THE DIFFERENCE BETWEEN THE OBJECTIVE AND THE PR
TPWR:	TRANSMIT POWER IN dBM OF THE TRANSMIT STATION IN THE INTERFERENCE CONFLICT
LL:	LINE LOSS OF THE INVOLVED TERRESTRIAL STATION
LOADING:	TRAFFIC LOADING OF THE INVOLVED TERRESTRIAL STATION
PLAN:	FREQUENCY PLAN OF THE INVOLVED TERRESTRIAL STATION
FREQ POL:	FREQUENCIES AND POLARIZATIONS OF THE INVOLVED TERRESTRIAL STATION

EARTH STATION NAME: RAPID CITY SD
CALL:
OWNER: Globalstar
COORDINATES: 44 5 0.0 103 10 0.0
GROUND ELEVATION: 3260 FEET AMSL ACL: 12 FEET AGL
ANTENNA: REFERENCE PATTERN 29-25LOG(THETA)
OBJECTIVES: RECEIVE: 0.0 (DBW / 1 MHZ) TRANSMIT: -154.0 (DBW / 4 KHZ)

	TERRESTRIAL PATH LAT LON CALL OWNER FREQ/POL	GND ACL TDISCT	EDISCT GTS	GES TANT LOADING	FSLOSS DIST AZ	PR MARGIN	TPWR LL	PLA
1	KBHE TV BLDGSDCAMP RAPID SD 44 03 09 103 14 38 KUH40 S08961: SOUTH DAKOTA STATE RADIO COMMUNICATIONS 6785.0000H	3836. 165.	10.0 87.3	7.0 -0.4	126.01 A63005	7.1 241.1	-130. 27.	20 1.0 72 CH MSG RCN:	HI
				EQUIPMENT: 2JRQ01 EMISSION: 10000F9					
2	MT COLLIDGE SDKBHE TV BLDGSD 43 44 43 103 28 50 KUH38 S08961: SOUTH DAKOTA STATE RADIO COMMUNICATIONS 6615.0000V	6010. 323.	10.0 4.7	7.0 14.7	142.13 A63005	45.2 214.0	-131. 26.	20 1.0 72 CH MSG RCN:	LO
				EQUIPMENT: 2JRQ01 EMISSION: 10000F9					
3	CAMP RAPID SDKBHE TV BLDGSD 44 04 54 103 15 50 KUH36 S08961: SOUTH DAKOTA STATE RADIO COMMUNICATIONS 6635.0000H	3350. 17.	10.0 294.9	7.0 -4.3	126.85 A63005	7.8 268.7	-135. 22.	20 1.0 72 CH MSG RCN:	LO
				EQUIPMENT: 2JRQ01 EMISSION: 10000F9					
4	MT TERRY SDKBHE TV BLDGSD 44 19 38 103 50 06 KUH23 S08961: SOUTH DAKOTA STATE RADIO COMMUNICATIONS 6595.0000V	7028. 190.	10.0 354.0	7.0 12.7	144.57 A63005	59.9 297.1	-137. 20.	20 2.0 72 CH MSG RCN:	LO
				EQUIPMENT: 2JRQ01 EMISSION: 10000F9					
5	KBHE TV BLDGSDMT TERRY SD 44 03 09 103 14 38 KUH40 S08961: SOUTH DAKOTA STATE RADIO COMMUNICATIONS 6745.0000V	3836. 385.	10.0 117.9	7.0 -13.5	126.01 A64006	7.1 241.1	-144. 13.	20 1.0 72 CH MSG RCN:	HI
				EQUIPMENT: 2JRQ01 EMISSION: 10000F9					
6	KBHE TV BLDGSDMT COLLIDGE SD 44 03 09 103 14 38 KUH40 S08961: SOUTH DAKOTA STATE RADIO COMMUNICATIONS 6765.0000V	3836. 385.	10.0 211.8	7.0 -15.3	126.01 A63005	7.1 241.1	-145. 12.	20 1.0 72 CH MSG RCN:	HI
				EQUIPMENT: 2JRQ01 EMISSION: 10000F9					
7	TEAKETTLE R WYPRAIRIE CTR WY 42 20 06 104 09 55 WHJ457 S01910: CHICAGO & NORTH WESTERN TRANSPORTATION 6635.0000V	4855. 30.	10.0 6.2	7.0 13.7	155.49 A63130	210.5 203.0	-146. 11.	30 1.0 480 CH MSG RCN:	LO
				EQUIPMENT: 2ZJN01 EMISSION: 10000F9					

TABLE E2.2-1 INTERFERENCE CONFLICTS

E3.0 Summary of Results

E3.1 General

In this section, the results of an analysis performed at two (2) selected locations are presented along with a general summary to discuss the overall results.

E3.2 Analyzed Locations

E3.2.1 Rapid City, South Dakota

A site was selected in the Rapid City, South Dakota area to determine the impact of a Globalstar feeder link earth station into the private operational-fixed service facilities licensed within 250 kilometers. This area was selected because of a limited number OFS licensed paths operating in the 6525 - 6875 MHz frequency band.

Table E3.2.1-1 presents a summary of all the cases analyzed in the Rapid City, South Dakota area.

Only two cases could not be resolved from the office analysis KBHE TV receiving from Camp Rapid on 6785 MHz, and Mt. Collidge receiving from KBHE TV on 6615 MHz.

Either one of these cases could possibly be resolved by limiting uplink power flux density in the appropriate part of the band.

In addition, either one of these cases could be resolved by determining any path blockage provided by buildings or other man made obstacles between the feeder station and the terrestrial station. The obstacles would result in greater transmission losses than those based on terrain only.

On-site radio frequency interference (RFI) measurements may indicate that the actual interference is not as high as predicted. The RFI measurements could also indicate that the predicted cases are within 15 dB of the objective. This quantization allows the prediction of the shielding effectiveness needed to protect the terrestrial facilities in the direction of the earth station.

TABLE E2.2.3-1
INTERFERENCE CASE SUMMARY
RAPID CITY, SD OPERATIONAL FIXED BAND 6.7 GHZ

	PATH ID	BAND	DIST (KM)	AZ (DEG)	ES DISC (DEG)	ES GAIN (DBI)	LOS LOSS REQ'D (DB)	OH LOSS 20% (DB)	OH LOSS 0.0025% (DB)	REVISED MARGIN 20% (DB)	REVISED MARGIN 0.0025% (DB)
1.	KBHE TV BLDGCAMP RAPID	6H	7.1	241.1	10.0	7.0	26.6	0.0	0.0	26.6	3.6
2.	MT COLLIDGE KBHE TV BLDG	6L	45.2	214.0	10.0	7.0	25.6	0.0	0.0	25.6	2.6
3.	CAMP RAPID KBHE TV BLDG	6L	7.8	268.7	10.0	7.0	21.8	26.8	25.3	CLEAR	CLEAR
4.	MT TERRY KBHE TV BLDG	6L	59.9	297.1	10.0	7.0	20.2	35.5	24.4	CLEAR	CLEAR
5.	KBHE TV BLDGMT TERRY	6H	7.1	241.1	10.0	7.0	13.4	0.0	0.0	13.4	CLEAR
6.	KBHE TV BLDGMT COLLIDGE	6H	7.1	241.1	10.0	7.0	11.7	0.0	0.0	11.7	CLEAR
7.	TEAKETTLE R PRAIRIE CTR	6L	210.5	203.0	10.0	7.0	11.2	62.8	37.7	CLEAR	CLEAR
8.	HAYES BILLSBURG	6L	154.6	77.4	10.0	7.0	10.8	53.9	20.7	CLEAR	CLEAR
9.	FT PIERRE HAYES	6H	205.2	79.9	10.0	7.0	9.3	56.4	28.4	CLEAR	CLEAR
10.	DAWES CDSP PASSIVE	6H	158.0	173.2	10.0	7.0	4.7	100.1	65.6	CLEAR	CLEAR
11.	DAWES CT HS PASSIVE	6L	140.2	174.4	10.0	7.0	-0.4	0.0	0.0	CLEAR	CLEAR
12.	HEMINGFORD HAY SPRINGS	6L	199.7	173.4	10.0	7.0	-0.5	0.0	0.0	CLEAR	CLEAR
13.	DOUGLAS SHAWNEE	6L	195.6	247.6	10.0	7.0	-0.9	0.0	0.0	CLEAR	CLEAR
14.	SHAWNEE DOUGLAS	6H	206.9	228.3	10.0	7.0	-1.4	0.0	0.0	CLEAR	CLEAR

ANTENNA TYPE : FCC REFERENCE, 32 - 25LOG (THETA)

SATELLITE ARC : 0 - 359 DEGREES
OBJECTIVES : -154.0 DBW -131.0 DBW

The site also could become viable by changing the terrestrial antennas to more directional antennas. This exercise could reduce the KBHE TV case by 27.3 dB, thus clearing this case. The Mt Collidge case will be improved by 16.5 dB, reducing it to a 6.2 dB case therefore, providing an opportunity to clear this site for an uplink.

Finally, the site could be re-located in the Rapid City area where the predicted cases could be reduced by taking advantage of terrain blockage.

E3.2.2 Staten Island, New York

In the 6 GHz private operational-fixed band, a site was analyzed in Staten Island, New York. This site coincides with an existing geostationary gateway and is considered to lie in a congested OFS environment. There were 351 cases identified as potential interference cases based on line-of-sight analysis and operating within the 6525 and 6875 MHz band. After terrain blockage was considered and the over-the-horizon (OH) losses calculated, there were 52 cases that remain to be resolved. The cases and there adjusted margins based on OH are presented in Table E3.2.2-1 which follows:

Path	Band	Distance Km	Azimuth Degrees	Revised Margin dB
Bound Brook-Linden	6L	29.7	271.2	55
Elmburst Ho-Woodside	6H	29.2	57.2	14.3
Trenton-Davidson Mil	6H	55.1	230.4	9.8
Woodbridge C-12th E 49th St.	6H	11.8	241.0	32.0
South Amboy-Kearny	6H	15.7	216.8	31.0
Kearny-South Amboy	6L	16.7	21.1	30.0
Town Center-Woodbridge C	6L	24.0	235.4	29.0
Creedmore-St Francis	6H	40.7	67.8	10.7
Holmdel-Maplewood	6L	23.1	179.4	14.0
World Trade-Todt Hill	6H	18.3	49.3	12.4
World Trade-St Francis	6H	18.3	49.3	11.4
Davidson Mil-Pierson St	6L	34.1	229.7	12.5
Pierson St-80 Park Plaza	6H	16.2	240.1	24
Maiden Lane - Telegraph Hill	6L	18.4	52.2	4.5
12E 49th St-Woodbridge	6L	24.1	44.8	7.0
Mt Freedom-Broad St	6H	40.2	307.4	22.0
Rock Quarry-Maplewood	6L	22.7	345.5	20.0
Linden-Bound Brook	6H	6.5	271.4	20.0
Raritan Toll-Woodbridge	6H	16.5	219.3	20.0
Cherryville-Warrenville	6H	16.5	219.3	20.0
Cranford-Kearny	6H	11.1	303.0	9.2
Cranford-South Amboy	6L	11.1	303.0	19.0
Woodbridge-Union Toll	6H	12.9	233.6	19.0
80 Park Plaza-Pierson St	6L	14.9	2.9	19.0
Rock Quaray-Doremus	6L	22.7	345.5	18.0
South Amboy-Cranford	6H	15.7	216.8	18
Union Toll-Woodbridge	6H	12.5	332.6	18
Woodbridge-Holmdel	6H	12.9	233.6	17
Kearny-Cranford	6L	16.7	21.1	16
Radio Tower-200 Park Avenue	6L	45.1	28.4	15
Armstrong-PanAm	6L	45.1	28.4	15
Kearny-Hoboken Terrace	6L	16.7	21.1	15
Woodbridge-Bloomfield	6L	12.9	233.6	14
Cheesecote-Empire State	6H	67.6	9.4	12.7
Berkley Hts-Matawan	6H	21.6	289.3	13.0
Jackie Jones-Rockerfeller	6L	69.5	7.5	13
Florkam Park-West Orange	6L	30.3	313.6	8
Rock Quarry-Warrenville	6L	22.7	345.5	12
Warrenville-Brookdale	6H	27.7	274.2	12
Doremus Ave.-Rock Quarry	6H	13.1	18.0	10
Woodbridge-Raritan Toll	6H	12.9	233.6	9
Randolph TN-Totowa	6L	39.4	310.0	8
Maplewood-Rock Quarry	6H	14.8	335.1	8
Randolph TW-Klinsville	6L	39.4	310.0	7
Randolph TW-Skyline DR	6L	39.4	310.0	7
Berkley Hghts.-Morristown	6H	21.6	289.3	7
Pierson St.-Davidson Mil	6H	16.2	240.1	6
Eagle Rock-Rockerfeller	6L	22.8	345.3	5

Table E3.2.2-1

A 15 dB shielding loss could customarily be used. A site shield completely surrounding an earth station, with proper height and distance from the station, is customarily given a 15 dB loss attribute. The 15 dB loss is accepted as a standard in the coordination community [5]. The results of applying 15 dB to all the cases in Table E3.2.2-1 are reflected in Table E3.2.2-2.

Path	Band	Margin dB
Bound Brook - Linden	6L	40
Woodbridge C - 12th E 49th St.	6H	17
South Amboy - Kearny	6H	16
Kearny - South Amboy	6L	15
Town Center - Woodbridge C	6L	14
Pierrson St - 80 Park Plaza	6H	9
Mt Freedom - Broad Street	6H	7
Rock Quarry - Maplewood	6L	7
Linden - Bound Brook	6H	7
Raritan Toll - Woodbridge	6H	7
Cranford - Kearny	6H	4
Cranford - South Amboy	6L	4
Woodbridge - Union Toll	6H	4
80 Park Plaza - Pierson St	6L	4
Rock Quarry - Doremus	6L	3
South Amboy - Cranford	6H	3
Union Toll - Woodbridge	6H	3
Woodbridge - Holmdel	6H	2
Kearney - Cranford	6L	1

Table E3.2.2-2
Site Shielding of 15 dB Considered

The original 351 potential cases at the Staten Island site have been reduced to 19 cases by the office analysis alone. The next step would be to conduct on-site RFI measurements and path blockage surveys to attempt to resolve as many of these cases as possible.

Although the office analysis does not prove that this is a viable site, it does show that the number of cases have been reduced to a workable magnitude.

F

APPENDIX F - UPLINK COMMON CARRIER BAND (10.7 to 10.95 GHz and 11.2 to 11.45 GHz)

F1.0 Introduction

F1.1 General

In this Appendix, an uplink from a Globalstar feeder station operating in the 10.7 to 11.45 GHz Common Carrier band is analyzed. The 11 GHz band is used extensively as the "last mile" connection for long haul, wide band systems. It offers a high capacity alternative to 6 GHz in areas of frequency congestion but has limited range (usually less than 10 miles) due to rain attenuation. Paths are typically licensed for at least eight channels to connect with a 4 or 6 GHz backbone; and in some cases, all twelve channels are employed. Two industry designated 40 MHz channel plans (HD/LE or HJ/LP) are used with capacities of 2400 channel FM/FDM or 3-DS3 digital. As with other bands used by the long haul carriers, channel assignments in this band declined steadily during the late 1980's. Cellular providers have increased use of the band during the last several years, offsetting this decline. There are approximately 4,500 paths operating in today's environment comprised of 66% digital, 19% FM/FDM, and 15% video. International Ku band earth stations utilize receive frequencies in portions of the 11 GHz band and must be considered when engineering an uplink feeder system. The 11 GHz band is well-suited for microwave paths shorter than 10 miles and is under utilized throughout most of the country.

The analysis was performed at two locations and based on the actual terrestrial microwave environment and the parameters of the proposed Globalstar feeder station. Sites were analyzed in Rapid City, South Dakota and Staten Island, New York to get a feel for the difficulties that may be encountered in a feeder station sharing the spectrum with in point-to-point terrestrial stations in a non-congested (Rapid City) and a congested (Staten Island) microwave environment.

F1.2 Basis for Analysis

The following parameters were used in the analysis.

- The maximum Globalstar uplink power density is -7.0 dBW/4kHz into the antenna.
- The proposed 3.4 meter antenna had a main beam gain of 49 dBi at 11 GHz.
- The antenna 3 dB beamwidth is 0.6 degrees at 11.0 GHz and 1.2 degrees at 15 dB beamwidth.

- The interference objective is -151 dBW/4kHz for 20 percent of the time at 11.0 GHz. This is based on current industry practices used to coordinate Ku band geostationary earth station pointing at the geostationary orbit which comply with the Code of Federal Regulation 47, Part 25.

- The earth station antenna gain pattern conforms to 32-25logθ towards the horizon. This is the pattern used in the frequency coordination with terrestrial users as stated in Code of Federal Regulation 47 Part 25 Section 25.251(c)(4).

- Based on a minimum elevation angle to the Globalstar satellite of 10 degrees, a minimum antenna gain towards the horizon is 7 dB (32-25 log 10 = 7dB).

- The maximum power density from the earth station towards the horizon is 0 dBW/4kHz (-7 dBW/4kHz + 7 dB = 0 dBW/4kHz).

- A coordination distance with a 250 kilometers radius was selected. The coordination distance is the distance within which all potential interference is evaluated. The 250 km distance corresponds to the maximum coordination distance for a geostationary earth station with equivalent parameters and a minimum elevation angle of 10 degrees.

- The orbital mechanics and the relationship to the amount of time the terrestrial station main beam is in the direction of the satellite is not addressed in this report.

F2.0 Methodology

F2.1 General

The goal of this study was to determine the potential interference cases that might be expected from a Globalstar feeder link earth station operating with the parameters given in Table F2.1-1.

The standard procedures employed to analyze a geostationary earth station uplink with minor adjustments have been followed in analyzing two sites as a potential uplink locations.

F2.2 Computer Analysis

Comsearch's extensive electronic database was utilized. Computerized calculations have been carried out for all terrestrial

SATELLITE EARTH STATION
FREQUENCY COORDINATION DATA
04/25/94

OWNER:	Globalstar
EARTH STATION NAME, STATE	RAPID CITY SD
LATITUDE (DMS):	44 5 0.0
LONGITUDE (DMS):	103 10 0.0
GROUND ELEVATION AMSL (FEET/METERS)	3260.0 / 993.6
ANTENNA CENTERLINE AGL (FEET/METERS)	12.0 / 3.7
TRANSMIT ANTENNA TYPE : 29 34	
11.0 GHZ GAIN (DBI)/DIAMETER (METERS):	49.0/ 3.4
3 DB/15 DB HALF BEAMWIDTH (DEG.):	0.30/0.60
OPERATING MODE:	TRANSMIT ONLY
TRANSMIT BAND (MHZ):	10700 - 11900 11250 - 11450
EMISSION DESIGNATOR	
MODULATION:	DIGITAL
MAX. AVAILABLE RF POWER (dBW/4KHZ):	-7.0
(dBW/MHZ):	17.0
MAX. EIRP (dBW/4KHZ):	42.0
(dBW/MHZ):	66.0
MAX. PERMISSIBLE INTERFERENCE POWER	
11.0 GHZ, 20% (dBW/4KHZ)	-151.0
11.0 GHZ, 0.0025% (dBW/4KHZ)	-128.0
RANGE OF SATELLITE ARC IN DEGREES (MIN/MAX):	0.0/ 359.0
AZIMUTH RANGE (MIN/MAX):	0.0/ 360.0
CORRESPONDING ELEVATION ANGLES:	10.0/ 10.0
RADIO CLIMATE:	A
RAIN ZONE:	5
MAX. GREAT CIRCLE COORDINATION DISTANCE (MI/KM)	
11.0 GHZ:	155.3 / 250.0

NOTE: HORIZON IS LESS THAN 0.2 DEGREES AT ALL AZIMUTHS

TABLE F2.1-1 EARTH STATION PARAMETERS

facilities within the selected coordination contour. These computations include computing the expected line-of-sight interference power into each common carrier station within 250 km from the Globalstar feeder link earth station site. Specific data such as antenna directivity fixed losses, and exact coordinates are used. The predicted cases for a typical non-congested location are presented in Table F2.2-1.

The cases which did not clear the interference criteria over-the-horizon loss (OH), was estimated using Comsearch propagation models. Note that these OH models are the same ones used to predict propagation losses for interference prediction in the common carrier bands.

F3.0 Summary of Results

F3.1 General

In this section, the results of an analysis performed at two (2) selected locations are presented along with a general summary to discuss the overall results.

F3.2 Analyzed Locations

F3.2.1 Rapid City, South Dakota - Non Congested Area

A site was selected in the Rapid City, South Dakota area to determine the impact of a Globalstar feeder station on the common carrier terrestrial facilities within 250 kilometers. This area was selected because of a limited number of common carrier licensed paths operating in the 10.7 - 11.45 GHz frequency band.

Table F3.2.1-1 presents a summary of all the cases analyzed in the Rapid City, South Dakota area. There was sufficient over-the-horizon losses to clear all cases.

DESCRIPTION OF GREAT CIRCLE INTERFERENCE CASE HEADINGS

TERRESTRIAL PATH:	SITE NAMES AND STATE OF THE TERRESTRIAL PATH THAT THE FIRST SITE LISTED IS THE TERRESTRIAL STATION INVOLVED IN THE INTERFERENCE CONFLICT.
LATITUDE:	LATITUDE OF THE INVOLVED TERRESTRIAL STATION.
LONGITUDE:	LONGITUDE OF THE INVOLVED TERRESTRIAL STATION
CALL:	FCC CALL SIGN OF THE INVOLVED TERRESTRIAL STATION
OWNER:	OWNER OF THE TERRESTRIAL PATH
GROUND ELEVATION:	GROUND ELEVATION (AMSL) OF THE INVOLVED TERRESTRIAL STATION
ACL:	ANTENNA CENTERLINE (AGL) OF THE INVOLVED TERRESTRIAL STATION
EDISCT:	EARTH STATION DISCRIMINATION ANGLE, IN DEGREES, TOWARD THE INVOLVED TERRESTRIAL STATION
TDISCT:	INVOLVED TERRESTRIAL STATION DISCRIMINATION ANGLE, IN DEGREES, TOWARDS THE EARTH STATION
GES:	GAIN OF THE EARTH STATION IN dBI AT THE CALCULATED EARTH STATION DISCRIMINATION
GTS:	GAIN OF THE INVOLVED TERRESTRIAL STATION IN dBI AT THE CALCULATED TDISCT
FSLOSS:	FREE SPACE PROPAGATION LOSS IN dB DUE TO THE DISTANCE BETWEEN THE EARTH STATION AND THE INVOLVED TERRESTRIAL STATION AT THE INTERFERENCE FREQUENCY
TANT:	INVOLVED TERRESTRIAL STATION ANTENNA CODE AND TYPE
DIST:	DISTANCE BETWEEN THE EARTH STATION AND THE INVOLVED TERRESTRIAL STATION IN KILOMETERS
AZIMUTH:	AZIMUTH IN DEGREES FROM TRUE NORTH FROM THE EARTH STATION TO THE INVOLVED TERRESTRIAL STATION
PR:	CALCULATED POWER RECEIVE IN dBW. PR = GES + GTS + (TPWR - 30) - FSLOSS - LL FOR RECEIVE PR = GES + GTS + PES - FSLOSS - LL FOR TRANSMIT
PES:	POWER OF EARTH STATION IN dBW/4 KHz
MARGIN:	MARGIN IN dB TO THE INTERFERENCE OBJECTIVE. THIS VALUE IS THE DIFFERENCE BETWEEN THE OBJECTIVE AND THE PR
TPWR:	TRANSMIT POWER IN dBM OF THE TRANSMIT STATION IN THE INTERFERENCE CONFLICT
LL:	LINE LOSS OF THE INVOLVED TERRESTRIAL STATION
LOADING:	TRAFFIC LOADING OF THE INVOLVED TERRESTRIAL STATION
PLAN:	FREQUENCY PLAN OF THE INVOLVED TERRESTRIAL STATION
FREQ POL:	FREQUENCIES AND POLARIZATIONS OF THE INVOLVED TERRESTRIAL STATION

EARTH STATION NAME: RAPID CITY SD
CALL:
OWNER: Globalstar
COORDINATES: 44 5 0.0 103 10 0.0
GROUND ELEVATION: 3260 FEET AMSL ACL: 12 FEET AGL
ANTENNA: REFERENCE PATTERN 29-25LOG(THETA)
OBJECTIVES: RECEIVE: 0.0 (DBW / 1 MHZ) TRANSMIT: -151.0 (DBW / 4 KHZ)

	TERRESTRIAL PATH LAT LON CALL OWNER FREQ/POL	GND ACL	EDISCT TDISCT	GES GTS	FSLOSS TANT LOADING	DIST AZ	PR MARGIN	TPWR LL	PLA
1	BUFFALO CRK WYNEWCASTLE P WY 43 59 08 104 49 46 KPX48 P9006 : US WEST COMMUNICATIONS, INC. 10755.000V	5020. 93.	10.0 336.7	7.0 14.3	155.98 R11100	133.7 265.9	-148. 6.	20 3.0 600 CH MSG RCN:	LP
	EQUIPMENT: 2PYE03 EMISSION: 28M0 F8W								
2	SHARP WYMOORCRAFT P WY 44 11 12 105 21 48 KPQ61 P9006 : US WEST COMMUNICATIONS, INC. 11245.000H 11485.000H	4834. 95.	10.0 12.1	7.0 12.1	158.37 A08200	176.2 274.5	-149. 5.	37 0.0 1344CH DIG RCN:	HJ
	EQUIPMENT: 2UTG01 EMISSION: 40M0 F7W								
3	NEWCASTLE WYNEWCASTLE P WY 43 51 16 104 12 09 KPP38 P9006 : US WEST COMMUNICATIONS, INC. 11685.000V	4344. 71.	10.0 247.5	7.0 5.5	152.23 R11100	86.9 253.3	-156. -2.	20 6.0 600 CH MSG RCN:	HJ
	EQUIPMENT: 2PYE03 EMISSION: 28M0 F8W								

TABLE F2.2-1 INTERFERENCE CONFLICTS

TABLE F3.2.1-1
INTERFERENCE CASE SUMMARY
COMMON CARRIER, RAPID CITY, SD, BAND 11.0 GHZ

	PATH ID	BAND	DIST (KM)	AZ (DEG)	ES DISC (DEG)	ES GAIN (DBI)	LOS LOSS REQ'D (DB)	OH LOSS 20% (DB)	OH LOSS 0.01% (DB)	REVISED MARGIN 20% (DB)	REVISED MARGIN 0.01% (DB)
1.	BUFFALO CRK NEWCASTLE P	11H	133.7	265.9	10.0	7.0	3.4	65.5	39.7	CLEAR	CLEAR
2.	NEWCASTLE NEWCASTLE P	11L	86.9	253.3	10.0	7.0	-4.7	0.0	0.0	CLEAR	CLEAR
3.	SHARP MOORCRAFT P	11L	176.2	274.5	10.0	7.0	1.7	65.8	37.2	CLEAR	CLEAR

ANTENNA TYPE : FCC REFERENCE, 32 - 25LOG (THETA)

SATELLITE ARC : 0 - 359 DEGREES
OBJECTIVES : -151.0 DBW -128.0 DBW